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SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

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This report presents unevaluated information on Soviet Bloc International Geophysical Year activities selected from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

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I. GENERAL

"Pravda" Editorial Stresses the International Cooperation of Scientists

An editorial appearing in the 27 August issue of Pravda adds a strong note to the oft-repeated Soviet refrain, the international cooperation of scientists..

This theme has been most prevalent during the International Geophysical Year, and was particularly stressed by the Soviets during the recent IGY conference held in Moscow.

The current editorial begins by saying that "the Communist Party and the Soviet government attach great importance to the development of creative associations of the scientists of our country with foreign scientific institutions. Soviet scientists regard the achievements of their foreign colleagues with deep respect and manifest a sincere desire to cooperate with them in the field of science in the interests of all mankind. Many generations of our scientists have warmly supported the idea of international cooperation."

"Soviet science regards the cause of peace and progress as its highest duty."

Following strong traditions, the editorial continues, the Academy of Sciences USSR together with other Soviet scientific institutions constantly strengthens its international ties. This year 32 prominent foreign scientists along with outstanding scientists of the USSR were chosen for membership in the Academy of Sciences USSR.

The contacts of the Academy of Sciences USSR with foreign scientists and organizations are being continuously expanded and strengthened. In the past year 514 delegations of the academy visited 44 other countries. In 1957, 139 delegations of the Academy of Sciences USSR participated in the work of 62 international congresses.

Long-term agreements on scientific cooperation were concluded by the Academy of Sciences USSR with the academies of sciences of the People's Republic of China, Poland, Czechoslovakia, Hungary, Rumania, and the Democratic People's Republic of Korea and with the German Academy of Science in Berlin. The relations between the scientists of the socialist countries and their strong creative friendship are inspiring examples for the scientists of all the world, says Pravda.

The Academy of Sciences USSR has agreements with the scientific institutions of a number of countries concerning the exchange of workers with the aim of specialization over a long period of time. Such agreements were concluded, for example, with the Royal Society of Great Britain and the Henry Poincaire Institute of the University of Paris. The library of the Academy of Sciences USSR exchanges books with 2,000 scientific institutes in 84 countries.

Moscow, it is claimed, is the greatest scientific center in the Soviet Union and is becoming more and more the greatest scientific center in the world. It was not accidental, Pravda continues, that three of the greatest international conferences evoking great interest among the scientific societies of many countries were recently held in Moscow. These were the international conference of architects, the regularly scheduled assembly of CSAGI (Special Committee for International Geophysical Year), and the Tenth International Conference of Astronomers.

The successes achieved by the scientists of all countries cooperating in the work of the IGY was so effective that the CSAGI assembly in Moscow resolved to continue the specified program of IGY investigations for still another calendar year, up to December 1959.

The international cooperation of scientists in the field of astronomy will give beneficial results. At the conference in Moscow the coordination of forces in astronomical studies was urged. A. Danjon, chairman of the conference, is quoted as saying that in Moscow a mutual understanding between the astronomers of the East and West and the scientists of many countries was achieved and friendly relations were begun.

One of the unusual characteristics of our times is the unusually rapid tempo of the development of science and engineering. Modern science and engineering make it possible to conduct large-scale investigations in a very short period of time which formerly took years. This makes scientific cooperation and personal encounters between scientists especially necessary and valuable. Scientific reports, conferences, assemblies, and discussions promote the establishment of personal contacts of scientists, the coordination of investigations, and the exchange of scientific information, which are extremely important for the future development of world science and engineering.

"The idea of international cooperation in the development of sciences and the use of its achievements in the cause of peace now find support among the scientific workers of the entire world," concludes Pravda. "Our scientists will in the future develop friendly associations with the scientists of all the countries of the world, assisting in the strengthening of peace in the whole world, and in the mutual understanding and cooperation between peoples." (Moscow, Pravda, 27 Aug 58)

Tenth International Astronomical Congress in Moscow

The Tenth Congress of the International Astronomical Union was held in Moscow from 12 to 20 August.

Soviet press coverage of the congress appearing in Pravda and Izvestiya presents no new information that was not reported by US press wire services. (Moscow, Pravda, 12, 13, 14, 15, 16, 17, and 20 Aug 58; Izvestiya, 6, 13, 14, 15, 16, 17, 19, 20, and 21 Aug 58)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Soviet Single-Stage Geophysical Rocket Attains 450-Kilometer Altitude

The second launching of a huge single-stage geophysical rocket to an altitude of 450 kilometers was accomplished in the USSR under the IGY program at 0806 hours Moscow time on 27 August. The launching was made in the middle latitudes of Soviet European territory.

The rocket carried, in addition to geophysical instruments for complex investigations of the upper layers of the atmosphere, two dogs in a hermetically sealed cabin.

The total weight of the geophysical scientific apparatus, radio telemetering devices, power sources, the hermetic cabin with the experimental animals, and auxiliary systems together with the instrument section was 1,690 kilograms.

The following instruments were carried by the rocket for scientific investigations:

An ultrashort-wave dispersion radiointerferometer for measuring the concentration of free electrons in the atmosphere.

An instrument for measuring the ion composition of the atmosphere.

An apparatus for studying the concentration of positive ions in the atmosphere.

An instrument for measuring the electron temperature.

Ionization and magnetic manometers for measuring air pressure.

Instruments for recording the impingement of micrometeors.

A solar spectrograph for recording the ultraviolet region of the spectrum.

An instrument for recording the infrared radiation of the Earth and the Earth's atmosphere.

A hermetic cabin in which the two experimental animals were placed was equipped with a regeneration system, a self-contained system for recording the biological functions of the animals, and a special motion picture camera for photographing the animals during flight.

The rocket was stabilized during the entire flight, including the inertial part of its flight, with the aid of special devices which prevented rotation around its vertical and horizontal axes. This was done to ensure the necessary conditions for conducting the scientific investigations.

The flight of the rocket was made at a small angle to the vertical in a fixed direction, landing in a selected area.

The preliminary results of scientific investigations with the aid of the first artificial earth satellites and rockets were published recently by the Interdepartmental Committee for the Conduct of the IGY under the Presidium of the Academy of Science USSR. One of the most important chapters of this publication is the chapter on medicobiological investigations by rockets.

The practice of using anesthetized monkeys in investigations conducted in the US is contrasted in the article with similar work in the USSR. The value of experiments using only anesthetized animals, as in the US, without the comparison of data obtained from unanesthetized animals, is somewhat lowered inasmuch as the use of narcotics would prevent the norma activity of the brain. In investigations conducted in the USSR, dogs were selected as the objects of biological experiments. These were raised in rockets both without narcotics and under narcosis.

Particular attention is paid to investigations of the activity of animals during flight in hermetically sealed rocket cabins up to altitudes of 212 kilometers.

Dogs weighing 5-7 kilograms were selected as experimental animals.

The animals were secured in specially made cradles using individual clothing and were placed in the cabin in pairs.

The hermetic cabin in which two dogs are placed is a section of the rocket nose cone. In it are arranged two detachable cradles for holding the animals, the regeneration apparatus, and the recording apparatus. The interior of the cabin is covered with a thick layer of felt. The specially developed motion-picture camera has a film speed of 24 frames per second. It holds 300 meters of film, ensuring photographing for 11-12 minutes.

Rockets launched up to a 212-kilometer altitude attained an ascending speed of 1.72 kilometers per second and a descending speed of 1.75 kilometers per second. The nose cone is separated from the body of the rocket at the uppermost point of the flight trajectory. The braking parachute of the nose cone is opened at 4 kilometers, and at 2 kilometers the main parachute system goes into operation. The nose cone lands in 605-606 seconds. The period of dynamic weightlessness lasts 360-370 seconds.

No ill effects as a result of these experiments were noted in any of the animals. The design of the hermetic cabin and its equipment ensures the necessary conditions for life at altitudes of 100-212 kilometers. Flight conditions in rockets up to these altitudes do not cause any sharp disturbances in the physiological functions of the animals. No behavior changes were noted after the flights. It is particularly pointed out that the parachute system of the nose cone worked without failure in all the rocket launchings and guaranteed the safety of the animals during landing.

The report also revealed the building of a globular ventilated space suit made of plexiglass with a detachable helmet and an oxygen feed system. All the calculations and designs of Soviet scientists and designers have proved correct. This maskless space suit guarantees the necessary conditions for the life of animals during flights in nonhermetic rocket cabins up to altitudes of 110 kilometers. Catapulting is a promising method of abandoning the cabins of rockets.

The 27 August launching which carried the two dogs, Belyanka and Pestraya to an altitude of 450 kilometers and then lowered them safely to Earth came after several months of training. Both dogs are reported in good condition.

A preliminary survey of the obtained materials showed that all apparatus worked normally during the flight and ensured obtaining the necessary scientific data.

The materials obtained as a result of this flight are being processed. (Moscow, Izvestiya, 30 and 31 Aug 58)

"Motors of Galactic Ships"

Discussing possible types of motors for cosmic flights, R. G. Perel'man, Candidate of Technical Sciences, reduces their number to three. These are the ion-propelled craft moved by the discharging of ionized gas particles dispersed in accelerators; nuclear rockets, in which motors create thrust by discharging particles obtained in nuclear processes; and quantum rockets, in which the flow of electromagnetic waves serves as the working medium.

Ion-propelled craft are considered the best apparatus for stellar flying of the future.

The idea of creating an ion motor is credited to K. E. Tsiolkovskiy. The latest in their development is the proposal to use cesium and rubidium as a working medium. These two metals are singled out because their atoms are heavy and easily ionized.

The power plant provides for a special device which generates the electrical energy necessary for the motor's operation. Cesium or rubidium is heated to the point of evaporation and enters into a chamber in which an incandescent grid (catalyzer) is located. In its passage through the grid, electrons are disassociated from the cesium vapor, that is, the atoms are ionized and acquire a positive electric charge; moreover, the number of ionized atoms reaches almost 100 percent. Thereafter, the ions and electrons are separated by the electrical field and are speeded up in the accelerators to a velocity of an order of 80-100 kilometers per second. Such an acceleration of charged particles is widely used in both science and engineering. After this the ions and electrons are fed in parallel "streams" into a nozzle, where they combine, and form a jet of precipitously ejected atoms.

One of the projects envisions the weight of a small automatic cosmic apparatus for flying around the planets of the solar system as consisting of 1.5 tons, of which the working medium is 100 kilograms, and the payload, 700 kilograms. The latter includes the weight of instruments for controlling the rocket at a distance. A 1,000-kilowatt nuclear reactor is specified as the source of energy for the motor. The heat from the reactor is carried away by liquid sodium and by means of a heat exchanger transferred to mercury. Mercury vapor thus formed will operate the turbines of an electric generator. Electric energy is used to heat the cesium up to 800° Centigrade and for bringing the tungsten grid on which the cesium vapor is ionized to a white heat. The flow of ions will be speeded up in the accelerator to 200 kilometers per second. The total thrust of the motor will consist of only 0.15 kilogram, giving the apparatus an acceleration of 0.01 percent the acceleration of gravity.

Preliminary calculations show that an ion-propelled craft with a payload of one ton, having five stages and a means of accelerating ions up to 20,000 kilometers per second and with a thrust of 50 times less than its starting weight, will reach an acceleration of one 50th that of gravity. With an acceleration up to 50,000 kilometers per second, which will require 7 1/2 years, the cosmic ship will move at this speed for 18 years, and after this period will require 7 1/2 years for braking. The entire flight to the Proxima Centauri would take about 33 years.

How close to realization is such an ion-propelled craft? At present ion accelerators exist which can discharge ions up to a speed of tens of thousands of kilometers per second, but the intensity of the flow of the ion discharge in them is as yet negligible, one millionth of one gram per second. At the same time the weight of the accelerator is tens and hundreds of tons. Even with the small thrust necessary for the ion-propelled craft, a great increase in the power of the acceleration and a sharp reduction in its weight are required; these are still unsolved engineering problems. In addition to this, the weight of the power source for the ship is very great.

This project will be realized, says Perel'man, only after light, small, and very powerful ion accelerators and power sources for the accelerators have been created. Modern physics has already begun to solve these difficult problems and it can be expected that ion-propelled craft will be built in the not too distant future.

Perel'man discusses the possibility of using nuclear rockets whose thrust can be created by nuclear fragments formed during a chain reaction and ejected thereafter by a regulated stream from a nozzle. The velocity of such particles is several tens of thousands of kilometers per second, and the amount of fission material can be measured in kilograms. This, it seems, is the way to the final solution of the problem of interplanetary flight.

However, in this project there still must be overcome the problem of dealing with the terrific heat generated in nuclear fission, a heat so intense as to melt the combustion chamber itself. Is it possible to pass almost all the energy by the ejection of particles from the rockets nozzle with only a negligible part of the particles' energy being converted into heat? Perel'man replies that to achieve this the motor must operate oppositely to the reactors such as are used in electric power stations, where it is necessary to use the maximum heat given off. For this, the fuel must first of all be in a gaseous state in which the nuclear particles would slowly scatter their energy into heat (the design for such a reactor already exists says Perel'man). Also, it is necessary to insulate the particles from the walls of the rocket's combustion chamber. This could be done, for example, with a magnetic shield similar

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Even the use of thermonuclear reactions would not supply the requirements of such a stellar flying ship. For this it is necessary to find a method of converting atomic nuclei into electromagnetic waves. Such processes are found in the fusion of particles and antiparticles, for example, of electron and positron. At present such processes on large scales are not possible since for quantum-propelled flying ships powerful sources of antiparticles or reserves of them would be necessary.

Today it is still completely impossible to visualize how "tanks" for containing antimatter must be made. Such a tank cannot be expected as long as it feeds the matter into the combustion chamber and instantly annihilates with the matter of the tank itself. In the fusion of particles and antiparticles "hard" electromagnetic waves (the so-called gamma rays) are formed. For these, even ideally polished screens are like grids. They will intensely absorb this radiation and with the enormous power of the radiation source this would cause instantaneous evaporation of the screens. Therefore the conversion of gamma rays, for example, into radio waves is necessary.

Finally, to cope with all these gigantic flows of radiation, the jet of the stellar flying ship must have a radiator with an enormous surface. Even if we assume that the concentration of radiation flow in the stellar flying ship's jet is ten times greater than it is on the Sun's surface, the radiation reflector must still have an area of tens of square kilometers.

The motors of such a giant ship would be of such size and power that they would be capable of boiling the ocean and displacing part of the Earth's atmosphere. Therefore, the construction of such a ship and its take-off, and return would have to take place at an extraterrestrial base.

Concerning the possibility of using very long radio waves (these are absorbed much less than visible light) it should be noted that directed flows of these waves possessing sufficiently high power are already in a stage of being created by modern technology. Finally, there is this important fact, the radio-wave screen reflector can be made in the form of an open network which will give a considerable decrease in weight. The use of radio waves is extremely alluring, but the difficult problem remains of how these radio waves are to be obtained. "Earth" sources for this purpose are unsuitable: their effectiveness for converting other forms of energy into the energy of radio waves is too small.

With the creation of powerful sources of such electromagnetic waves, which will not be absorbed by more than one one billionth, the building of stellar flying ships will become a reality.

In concluding, Perel'man says that with the building of radiation rockets man will take another step toward the mastering of space and time. According to Einstein's theory of relativity, the quicker a body moves, the slower time moves for it. This retardation is considerable only at velocities near the speed of light. If the velocity of a rocket varies from the speed of light by only one hundredths percent, then time will pass about 70 times more slowly than on Earth. Thus the life at astronauts will be lengthened although they will be unaware of it in flight.

Only this makes it possible to consider that man will succeed in penetrating into the depths of terrestrial space tens and hundreds of light-years distant from us. To pass through our galaxy a beam of light takes about 100,000 light-years.

Today it is possible to assume that in the foreseeable future the first ion-propelled flying ships will be built which will bring us nearer the solution of such problems as flights to the planet systems nearest us.

It is possible that toward the end of this century basic theoretical developments in the field of stellar flying ships will be finished and in the next century these apparatus will carry men to other worlds. (Nauka i Zhizn', No 7, Jul 58, pp 60-64)

III. UPPER ATMOSPHERE

Physics of the Upper Atmosphere

In his prefatory abstract of "The Interplanetary Medium and Some Problems of Physics of the Upper Atmosphere," I. S. Shklovskiy, Institute of Physics of the Atmosphere, Academy of Sciences USSR, writes as follows:

Interplanetary gas should be in a state of dynamic equilibrium. As a result of dissipation from interplanetary space and accretion by the Sun, the interplanetary gas must be "renewed" in the Solar system every - 10^3 - 10^4 years. Perhaps the ejection of matter from the Sun is a source of interplanetary gas. Evidently, the chemical composition of interplanetary gas is similar to that of the solar atmosphere. The concentration of neutral hydrogen atoms is ~ 0.5 cm^{-3}, of ionized hydrogen atoms ~ 200 cm^{-3}.

The state of ionization of interplanetary gas is studied. Because of the great contamination of interplanetary plasma, processes of neutralization of atoms of dust particles can be very effective, and this can considerably increase the relative abundance of neutral atoms in interplanetary space. The charge of interplanetary dust particles should be negative, their potential ~ 1 volt.

As a result of the comparatively large abundance of neutral hydrogen atoms in the interplanetary medium, the geoactive solar corpuscles must be recharged. As a consequence of such recharge, neutral hydrogen atoms should be present in corpuscular streams. These neutral corpuscles are not deflected by the magnetic field of the Earth and can be the cause of such phenomena as aurorae illuminated by the Sun and aurorae in low latitudes. During the recharge of geoactive protons in interplanetary space, excited hydrogen atoms can be formed. Therefore, the emission of H_α in interplanetary space can be expected when corpuscular streams pass through it, and may be observed under favorable circumstances.

It is shown that the accretion of interplanetary helium is an essential source of replenishment of the Earth' atmosphere with helium. The problem of density and temperature in the upper exosphere and also the isotopic content of atmospheric helium are analyzed. It is probable that He^3 is also captured by the Earth from the interplanetary medium. In this case, the isotopic content of helium in the interplanetary medium can be estimated. It was found that it is of the same order as that for the equilibrium state if the proton-proton reaction is active. (Astronomicheskiy Zhurnal, Vol 35, No 4, Jul/Aug 58, pp 557-571)

Zodiacal Light

In "The Polarization of Zodiacal Light," by V. G. Fesenkov, Institute of Astrophysics, Academy of Sciences Kazakh SSR, it is shown that the polarization produced by free electrons, presumably composing the zodiacal light, equals at the maximum 43%, 60%, and 67%, depending on the electron distribution concentration which varies with the distance from the Sun according to the law r^{-n}, where n = 0.1·2.

Inasmuch as the observed polarization of the zodiacal light does not exceed 20 - 25%, it may be concluded that the free electrons can account for no more than half of the observed brightness, under assumption that dust particles produce no polarization whatsoever.

In reality, however, as follows from theoretical calculations based on Mie's theory, dust particles produce a very sensible polarization. The latter is also confirmed by observations of atmospheric aerosols, dust tails of comets, etc. The detailed observations of polarization and atmospheric extinction made by Ye. V. Pyaskovskaya-Fesenkova (Doklady AN SSSR, at press) in the dry Libyan desert south of Aswan facilitate the deduction of the fraction due to atmospheric aerosols at different angles of scattering. This permits the calculation of the polarization of the zodiacal light composed of such particles. The obtained value equals approximately 27%. Therefore the assumption of free electron abundance in zodiacal light is superfluous. (Astronomicheskiy Zhurnal, Vol 35, No 4, Jul/Aug 58, pp 513-519)

IV. OCEANOGRAPHY

On the Vityaz' in the Central Part of the Pacific Ocean

The 26th voyage of the Vityaz', and its second under the IGY program, was an expedition in the central part of the Pacific Ocean. This was conducted by the Institute of Oceanology, Academy of Sciences USSR, in the period from November 1957 to February 1958.

A description of the voyage appears in the August issue of the Soviet popular science periodical, Priroda in an article entitled "On the Vityaz' in the Central Part of the Pacific Ocean," by V. G. Bogorov, Corresponding Member of the Academy of Sciences USSR, Institute of Oceanology, Academy of Sciences USSR.

The study of geographic zonality, the deep circulation of the waters, the deep water depressions of the Southern Hemisphere, and the collection of oceanological materials according to the standards of the IGY program for all countries entered into the program of the expedition. The expedition

was also commissioned to establish contacts with foreign scientists. The route provided for a twofold meridianal traverse of the central part of the Pacific Ocean along 174° W longitude and 173° E longitude from 33° N latitude down to 42° S latitude.

The Vityaz' visited the ports of Suva, Fiji Islands; Wellington, New Zealand; and Noumea, New Caledonia. The Vityaz' expedition was under way 115 days, during which time 113 stations were established. The voyage covered 17,425 miles. The total scientific complement of the expedition numbered 70 men. Among these was Sun Ti-shan, a scientific associate of the People's Republic of China.

The ship left Vladivostok on 5 November 1957 and entered the Pacific on 6 November.

The majority of the investigations required that anchor stations be established, only meteorological and fathometer observations being conducted while under way. Water, soil, and animal samples were taken, and radiosondes were launched at anchor stations.

Three unusual zones of the ocean were studied while crossing the tropics: the North Equatorial Current, in which the water moves from east to west; the Equatorial Counter Current, where the water moves from west to east, and the South Equatorial Current, where the water again flows from east to west.

The zone of the Equatorial Counter Current, where the deep waters rise to the surface, was especially interesting. These waters, at a depth of 300 meters, are 4 degrees colder than they are to the north and to the south of the equator at the same depth. The low temperature and other characteristics attest to the deep origin of these waters. The rising waters carry with them many nourishing salts, especially phosphates and nitrates. The algae of plankton do not live deeper than 200 meters. They quickly consume the nutritive salts in the surface of the ocean and the rich compounds of nitrogen and phosphorous rising from the deep waters, and fertilize the surface photosynthesizing layer of the sea water. The accumulation of nutritive salts in the depths occurs continuously because of the decomposition of organisms. As soon as the salts rise upwards to the point where the Sun's rays penetrate, there immediately begins a violet development of plant plankton. Increased masses of plankton are observed only in the area of rising waters in the shole of the tropic region. This is also the reason for the abundance of fish which, in the open sea, feed either directly or indirectly only on plankton. The abundance of plankton in this region even leads to a decrease in the transparency of the waters by 10 meters, and to a decrease in the weight by volume of the sedimentation. The latter occurs because of the settling of the remains of plankton organisms to the bottom.

Thus, it can be seen that physical phenomena (the rising waters) cause changes in the chemistry of the waters, the latter acts on the life of the ocean, and the abundance of organisms affects the transparency of the waters (physical characteristic) and the sediment accumulation (geology of the ocean). Such is the interconnection of the different phenomena and processes which characterize the unique nature of the ocean.

The waters of the ocean are carried enormous distances by these trade currents, and in so doing, their reserve of nutritive materials are decreased. Thus it is that these waters are very poor in life. There are only half as many fish here as there are in the intertrade zone.

The Vityaz' reached Suva, Fiji Islands, on 11 December and remained 5 days. During this time, more than 5,000 visitors boarded the ship. The scientific members of institutions of the island were shown the ship's equipment and some of the results of the investigations. Members of the Vityaz' expedition visited Fijian scientific institutions and services and acquainted themselves with the work under the IGY which is being conducted on the island. The warm greeting and friendliness of the people and the officials of the island greatly impressed the members of the Vityaz'.

The expedition next conducted operations in the Tonga depression from 21 to 30 December, and from there to the Kermadec depression from 31 December to 8 January. Here, a maximum depth of 10,840 meters in the Tonga depression and 10,030 meters in the Kermadek depression were found. Studies of the location and the geological structure of ocean bottom in these regions was conducted by Academician A. N. Zavaritskiy, N. S. Shatskiy, and other geologists. A map of life on the bottom of the depressions was made by Prof L. A. Zenkevich, who conducted extensive investigations of the quantitive distribution of bottom fauna. He found that the biomass (weight per one square meter) at the 10 kilometer level was almost 1,000 times less than the biomass of benthos at 1,000 meters. The variety of species was 100 times less. In addition, a number of old and primitive forms were discovered which are only found here.

A study of the depressions with a view to determine their currents and the exchange of their waters was made. This was done because of the definite statements in "foreign" scientific circles on using these depressions for dumping atomic wastes. It was found that no bar existed to the free exchange of the waters at the bottom of these depressions and that no definite "rim" to contain them existed. Waters rich in oxygen freely reached the bottom, and there was no hydrogen sulfide or accumulation of salts at the bottom. As a result of the studies, it was found that there is good circulation of the waters in the depressions, a mixing of the whole depth of water (almost 11 kilometers) and the rise of water from near the bottom into the surface layer.

Following these studies, the Vityaz' continued southward, reaching Wellington, New Zealand, on 12 January. Here again contacts were established with New Zealand scientists and officials. A conference on the scientific work fulfilled by the Vityaz' was conducted by the Soviet expedition with New Zealand scientists. In addition to the Prime Minister of New Zealand, the Mayor of Wellington, and other officials, the diplomats of many countries, scientists, participants of the US Antarctic expedition, and more than 2,000 citizens of the city visited the ship.

The Vityaz' sailed from Wellington on 18 January and continued its investigations as planned along the 172d meridan E. A stop was made in Noumea, New Caledonia. Here again, the pattern of the friendly visit was repeated.

The voyage was again resumed. Stations were established along the northern course of the vessel, the last being made at 30° N latitude.

During the voyage, the following procedure was adhered to at stations: 25 hydrological series down to the bottom and 96 down to depths of 2,000 meters were taken; geologists took 41 sediment cores, made 16 photographs of the bottom and set off 29 shots for determining by the seismoaccoustical methods the bottom structure of the ocean; at 16 stations, samples of plankton down to the bottom were taken and at 97 stations, samples were taken down to 500 meters; animal life from the bottom was collected at 60 stations; fish from the greatest depths were taken at six stations, and from depths of 1,000 meters at 89 stations.

By making two meridianal profiles it was possible to make a comparative study of some of the findings. For instance, it was found that the boundaries of the trade currents in these two profiles were different. The North Equatorial Current at the 172d meridian E longitude extended from 18° N to 14° N latitude, and along the 174th meridian W longitude, from 22° N to 8° N latitude. The equatorial counter current along 172° E extended from 14° N down to 4° N latitude, and along 174° W, from 8° N down to 4° S latitude. The South Equatorial Current was especially wide along 172° E, occupying an area from 4° N down to 4° S, that is more than 1,000 miles, while at 174° W, it is narrowest, being only 600 miles wide.

The region of the spread of the north subtropic waters greatly decreased after 3 months. At the beginning of the voyage, at the end of November, the southern boundaries of these waters were found to be at 22° N and at the end of February at 18° N latitude. Thus during winter, there occurs a significant spread of cold waters southward and a reduction in the region of circulation of the North Equatorial Current from 840 to 240 miles. In the southern hemisphere, in view of the close interval between observations, no change in the boundaries of the subtropic waters was observed.

The last leg of the Vityaz' voyage was made in bad weather. Bogorov is high in his praise of the scientific personnel and the ship's command for the manner in which they performed their duties even under the most difficult conditions. (Priroda, No 8, Aug 58, pp 66-73).

V. ARCTIC AND ANTARCTIC

Antarctic Temperature Continues to Drop

On 25 August, at noon, Greenwich time, the Soviet antarctic station Vostok near the south geomagnetic station pole registered the lowest temperature so far recorded on the Earth, i.e., minus 87.4 degrees Centigrade.

A correspondent of Izvestiya visited the Moscow Center of the Soviet Antarctic Expedition and the Central Institute of Weather Forecasts and asked some of the specialists to comment on the observations made by Soviet scientists.

According to O. N. Komova, chief of the Weather Bureau of the Main Administration of the Northern Sea Route, no one has ever experienced such low temperatures as the Soviet scientists at the station Vostok. The report from that station was received late in the evening of 25 August, stating merely that the temperature was minus 87.4 degrees Centigrade and the wind was northwest with a velocity of 3 meters per second. During the following 3 days, a strong disturbance of the ionosphere caused a complete disruption of radio contact on all wave bands, so that the above-mentioned report is the only one so far received from Vostok.

At present, it is the end of the polar night in the Antarctic and this temperature is not the absolute limit, according to a statement made in the Central Institute of Weather Forecasts by O. G. Krichak, Candidate of Geographic Sciences, who recently returned from Antarctica, where he headed the aerometeorological detachment of the Second Soviet Expedition.

This severe frost is explained by the fact that a zone of high atmospheric pressure, i.e. an anticyclone with calm, clear weather, prevails over Antarctica. This causes an intense cooling of the Earth's surface, which constantly radiates heat into space. Observations have shown that during the past few days, all Soviet stations in Antarctica recorded a sharp cooling off, connected with the shift of the center of the anticyclone from its usual position over the "pole of relative inaccessibility" to the area of operation of the Soviet Antarctic Expedition.

An exposure to these temperatures causes an enormous loss of heat by the human body. Some of the effects are: injury to the peripheral tissues; changes in metabolism; disturbed coordination between the flow of arterial and venous blood; and changes in the functions of some of the internal secretory glands.. To prevent these changes from causing pathological changes in the human organism, the polar scientists are permitted to work outdoors not more than 20-30 minutes at a time, using protective masks for the face and electrically heated clothing equipped with special pocket-size 40-watt heat generators.

On the evening of 28 August, radio contact with Antarctica was re-established. At 1500 hours Moscow time on 28 August, the temperature at Vostok was minus 84 degrees Centigrade. (Moscow Izvestiya, 29 Aug 58)

New Publication on Antarctic Research

Since January 1956, when Soviet scientists first set foot on the Antarctic continent, research work in that region has been going on continuously. Valuable material has been collected, which is now being processed and will be published in Trudy Kompleksnoy Antarkticheskoy Ekspeditsii (Works of the Complex Antarctic Expedition). In addition, to inform Soviet scientists and a wide circle of readers of the achievements and current activities of Soviet explorers in Antarctica, it has been decided to publish an information bulletin. The first number of this bulletin has just been printed.

The publication contains not only interesting general information on the scope of research of Soviet scientists, but also descriptions of the way in which some of the mysteries of Antarctica have been solved.

New islands, capes, and mountains have been discovered, which had not been shown previously on any geographic map. It was established that the ice reserves concentrated in Antarctica are greater than had been assumed, and that the glaciers are gradually retreating, although more slowly than in the North. The causes for the occurrence of storm winds in the "raging" 40-degree and 50-degree latitudes have been discovered. An unusual, previously not observed, "serrated" form of ice barrier was found, with ice bays resembling fiords. Some interesting and at the same time unexpected results were obtained on the geological age of pre-Cambrian formations in the eastern part of the continent. The distribution of icebergs in the region of Davis Sea was studied...

In addition to articles and communications of a scientific nature, the bulletin also contains "Notes of an Observer."

Probably many people have heard about the unusual phenomenon known as "singing icebergs." Scientists witnessed this phenomenon for the first time near Haswell Island, not far from Mirnyy. They were attracted by the strange form of the iceberg and drawing nearer, they suddenly heard a thin, high sound. As the sound grew stronger, it also became deeper, resembling an organ tone. When the scientists were close to the iceberg wall, they noticed that air was escaping through one of the numerous cracks at the same intervals as the sound, alternately becoming louder and softer. It appeared that the ocean swell alternately raised and lowered the water level around the iceberg, and the water moved inside the cracks as in connecting vessels, pushing out the air. Probably one of these cracks caused a vibration of air, similar to that originating in an organ pipe. Each new wave caused a repetition of the same musical phrase...

Another interesting phenomenon was observed by scientists in the "Valley of Death" on Ingrid Christensen Coast, a unique antarctic oasis. A 15-kilometer narrow valley extends there from the sea into the interior. A large lake has been formed at the bottom of this valley. Since the air in the valley is unusually dry, the level of the lake has dropped below the sea level. The salinity of the lake has become six times as high as that of the sea, and the salt has been deposited in layers along the shores. Almost no living organisms exist in this water, only occasional bacterial scum is found. There is no life on the shores of the lake either, not even moss or lichens. Only some dried-up or salt-crusted remains of shells, sponges, and even seals, are found among the rocks.

The bulletin also contains interesting reports of the cooperation between scientists of various countries. In the opinion of M. M. Somov, chief of the Complex Antarctic Expedition, Antarctica has become the arena for a successful experiment in joining the efforts of scientists of all countries. Here, says the scientist, is an atmosphere of friendship and disinterested mutual assistance, which is so necessary for the development of science. (Moscow, Izvestiya, 4 Sep 58)

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